(12) UK Patent Application (19) GB (11) 2 014 799 A

(21) Application No 7900910
(22) Date of filing
10 Jan 1979
(23) Claims filed
10 Jan 1979
(30) Priority data
(31) 9310
(32) 12 Jan 1978
(33) Italy (IT)
(43) Application published
30 Aug 1979
(51) INT CL² H01T 19/04
(52) Domestic classification
H1X 5G
(56) Documents cited
GB 1331691
GB 1281553
GB 1180055
GB 1130983
GB 1065084
GB 921473
(58) Field of search
H1X
H5H
(71) Applicant
Gianfranco Galimberti
Via Pancaldo 4
Milano
Italy
(72) Inventor
Mario Cipriani
(74) Agents
Mathisen Macara & Co

(54) Corona discharge treatment of plastics materials

(57) Device for processing plastics film surfaces by electric discharges distributed over the film passing between two electrodes between which the discharges occur.

One of the electrodes is divided into a plurality of elementary operative electrodes (14), which, in conjunction with a dielectric (11) and a plate (13) connected to a high voltage source (1), effectively form a plurality of parallel capacitors. The other electrode may be a roller (15A) or bar.

The working width may be varied by inserting dielectric members between the electrodes, by altering the length of the bar electrode, or by energising only selected electrodes (14) by correspondingly dividing the plate (13) and connecting to the voltage source via a commutator.

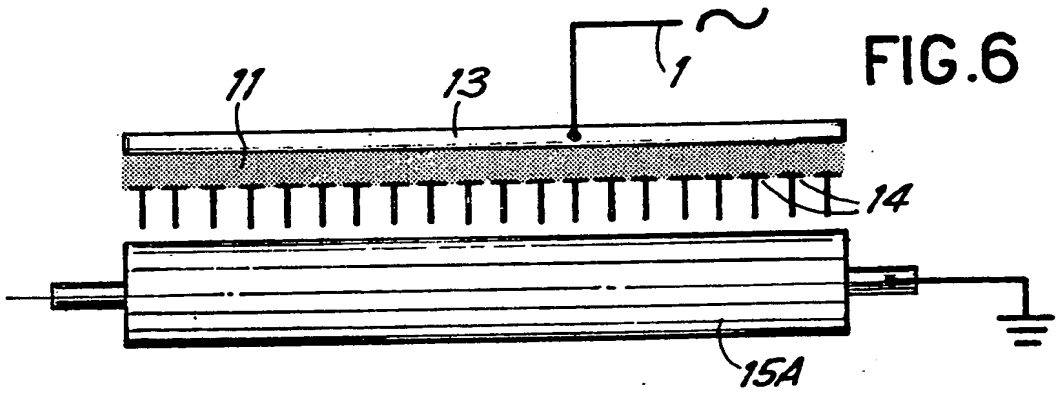


FIG.6

GB 2 014 799 A

2014799

FIG.1

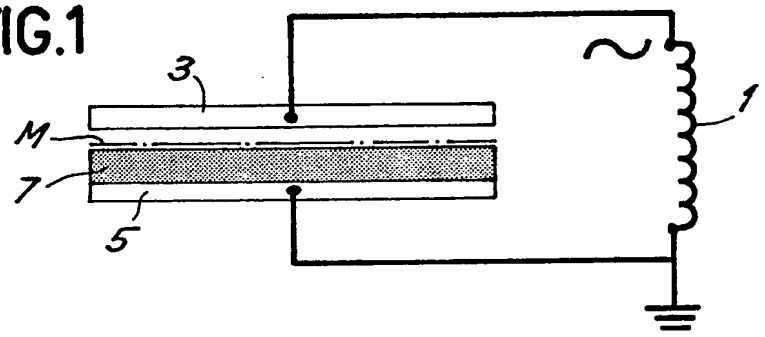


FIG.2

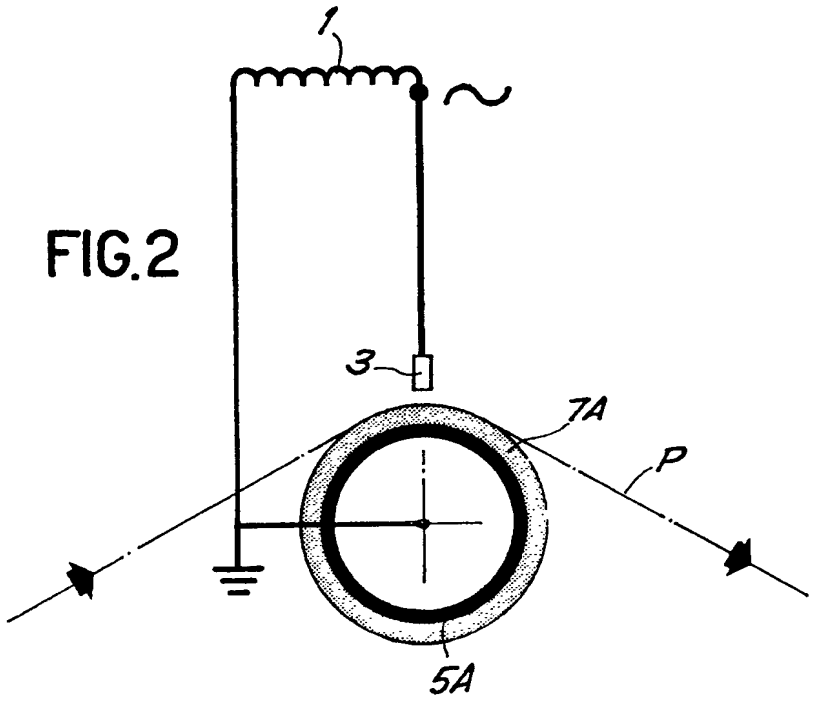
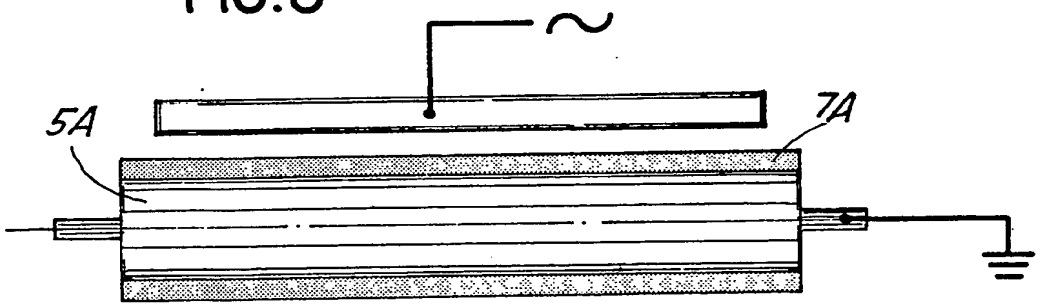


FIG.3



2014799

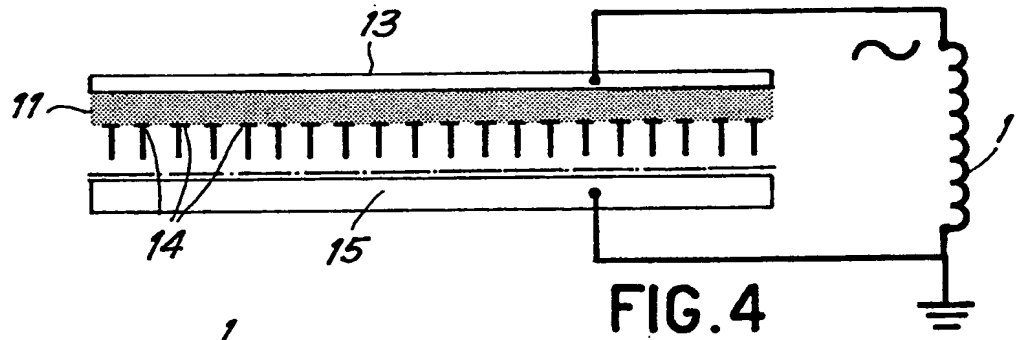


FIG.4

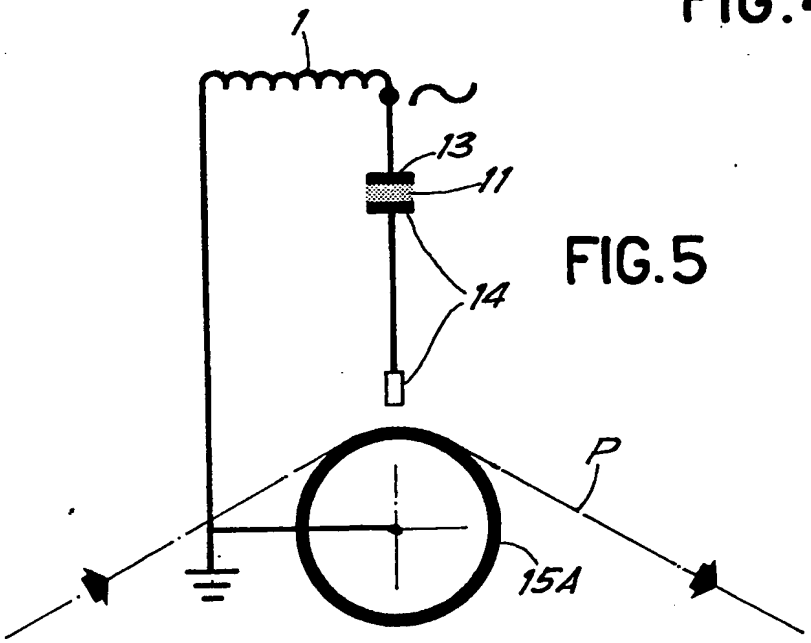


FIG.5

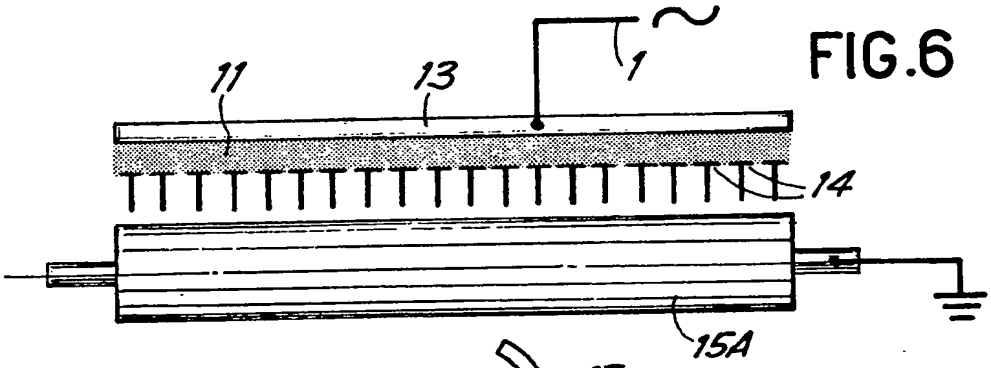


FIG.6

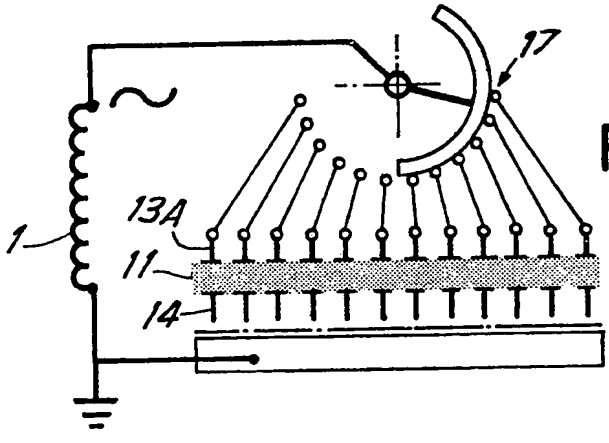


FIG.7

2014799

FIG. 8

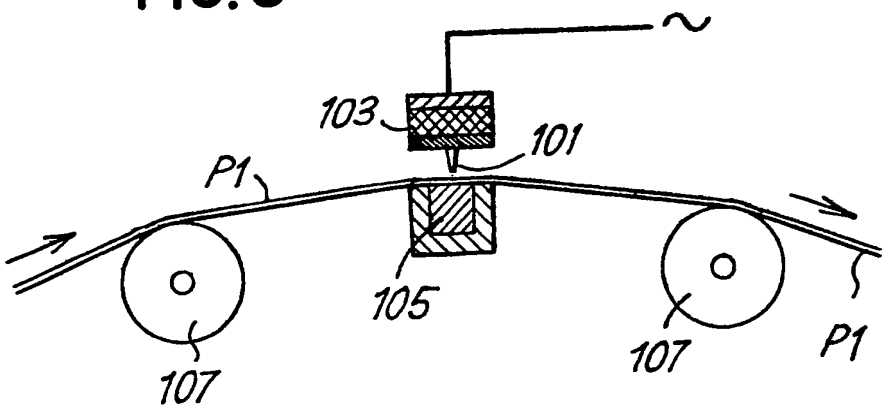
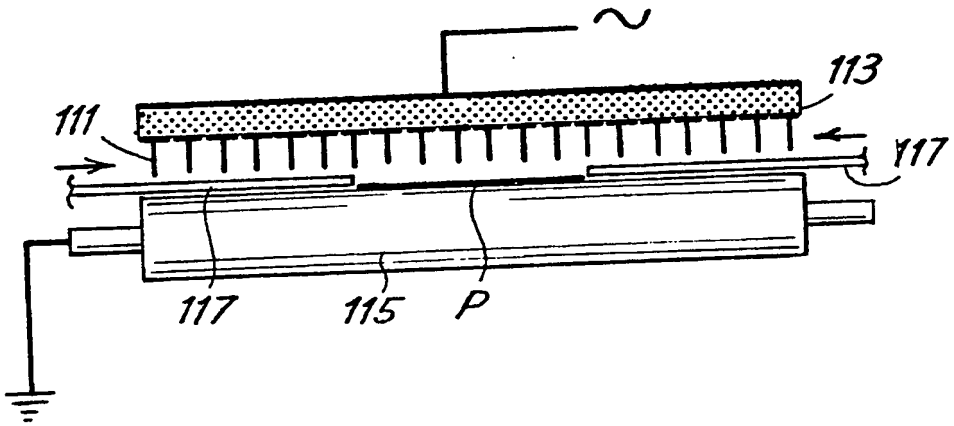


FIG. 9



SPECIFICATION

The surface treatment of plastics materials

It was experimentally observed that the effects of an electric discharge on plastics surfaces presumably consist of a change in the surface characteristics—in almost all of the plastics—mainly due to a surface oxidation. Such a change betters the "wettability" condition of the surfaces, that is it modifies the cohesion molecular force of the liquids withe respect to the adhesion force; practically this facilitates the fixing of inks and the like onto the surfaces themselves, and it allows the printing on plastics films.

A basic problem is that to obtain an evenly distributed electric discharge on the surface being processed. In order to obtain that, the so-called "Corona effect" is used by interpositioning between the two electrodes a dielectric body which diffuses the discharge and avoids its concentration on the geometrically less distant place. The plastic being worked—practically a thin film—should be the ideal dielectric in case there were no problem with the edges of the same; since the edges are also to be processed, there may be no dielectric outside the plastic edges, wherein a direct discharge may occur. When a direct discharge, namely an electric arc, occurs in a place, the Corona effect as a consequence disappears on all the other regions since the potential difference ceases. Since the dimensioning of the electrodes such as to avoid side discharges is impossible, there is, practically, the necessity for one of the two electrodes to be coated with a base stationary dielectric. That requires the applied potential difference to be increased, and therefore the losses in the dielectric itself also increase.

In order to reduce the danger of perforation of the base dielectric, said dielectric is often made thicker, but to maintain the working efficiency the potential difference is to be increased, which results in rendering much greater the risk to damage the dielectric through localised tensions and the like.

In Figs. 1, 2 and 3 the structures presently designed to obtain the Corona effect are diagrammatically shown. In Fig. 1, 1 denotes the potential generator, practically a transformer elevator secondary, 3 and 5 denote the two electrodes, 7 denotes the base dielectric thickness, and M the plastic. Figs 2 and 3 show the diagram for the continuous processing of a tape film P, which film is deviated by a cylinder 5A representing one of the electrodes, coated with a base dielectric 7A. From the electric point of view, the units of electrode 3, counterelectrode 5 or 5A (cylinder), and base dielectric 7 or 7A, and also the film M or P being worked form a condenser, on which the potential difference obtained by transformer 1 discharges with a Corona effect.

It is the object of this invention to provide a device for processing plastics surfaces through electric discharges evenly distributed on the surface to be processed, having two electrodes between which there is a constant potential difference and between which the plastic to be processed passes. It is the object of this invention to provide a dependable effective device, capable of ensuring processing uniformity.

According to this invention, one of the operative electrodes is divided into a plurality of elementary operative electrodes, each being connected to one of its condenser plate; the other condenser plate is the feeding plate and is connected to the high tension source. Practically the multiple elementary operative electrodes are carried by a bar and cooperate with the cylinder for bearing and deviation of the advancing plastic to be processed, which cylinder is an operative electrode connected to the high tension source.

Furthermore a variation of the processing active front can be provided.

According to a first embodiment of this invention, the undivided operative electrode width can be varied; said electrode can consist of a small replaceable or extensible bar which is skimmed by the plastic.

According to another embodiment, the feeding plate is divided into a series of elementary plates independent from each other and apt to be gradually connected to the high tension source through a collector or commutator, in order to vary the number of the elementary operative electrodes when working and thereby the area involved with the processing.

According to still another embodiment, the variation of the working front is obtained by inserting dielectric thicknesses through the space between the operative electrodes; that can be obtained through the insertion on the two sides of the working front.

The disclosure will be better appreciated following the specification and the annexed drawing, which shows a practical non-limitative embodiment of the disclosure itself. In the drawing:

Figures 1 to 3 show already known diagrams, of conventional solutions;

Figure 4, 5, 6 and 7 diagrams of solutions according to the invention;

Figures 8 and 9 show alternative solutions to change the working front.

According to the diagrams of Figs. 4, 5 and 6, the electrode which is the object of the invention consists—in principle—of a small capacity condenser battery, provided with a dielectric 11, a plate 13 in common (ideally a plurality of parallely connected plates) feeded by transformer 1 and a plurality of plates 14 ending in one or more spark gap-shaped points, forming elementary electrodes directly opposing the opposite polarity electrode 15—practically cylinder 15A—without inser-

tion of any stationary dielectric between portions 14, 15 except the plastic M or P. During operation, also with no dielectric plastic being worked a discharge from each of said points is obtained, said points are members of a battery of condensers in series, each charged according to its electric capacity. Practically the above related trouble does not occur, thus the diffused discharge is transformed in a localized electric arc at the less distant place, where there is no dielectric or the dielectric is less effective. By a suitable point density in the working front length unit, a substantial processing uniformity of the plastic M or P inserted in the electrode is reached, since the discharge diffusion to the involved area is obtained through the Corona effect, and that even in the case that the direct discharge should remain in the side regions, said direct discharge is peculiar of any member in the absence of the plastic.

A first positive consequence of the present arrangement is that it allows to operate with a lower electric potential difference as compared to now systems which use a thick dielectric coating; consequently also a greater safety is granted to the operators.

While in the diagram of Figs. 4 to 6 it is provided to carry out the condenser battery with a common plate 13, a series of independent plates 13A can be advantageously provided (see Fig. 7), which can be parallely connected through a commutator or collector 17, so as to put under tension only the region actually involved with the working being on process, and to avoid side discharges. Thus the working front magnitude can be rapidly varied.

The working front magnitude can also be obtained, according to the solution of Fig. 13, by providing multipointed electrode 101 according to the invention, with feeding elementary condensers 103; the other electrode 105 consists of a small replaceable bar to have various lengths and therefore variable working front; small bar 105 is skimmed by the plastic P1 advanced by two cylinders 107.

According to the embodiment of Fig. 8, elementary electrodes 101, feeded through condensers 103, cooperate with a small bar 105 which forms the other electrode, for example a ground electrode. Between the plurality of points of electrode 101 and the small bar 105 the plastic P1 passes, said plastic being guided by small bar 105 and two transmission rolls 107. The small bar 105 can be replaced, and selected of a length to correspond, every time, to the working front width; alternatively the small bar can be lengthened so as to form, for example, two sliding portions.

In the embodiment of Fig. 14, the divided electrode points 111, feeded by condenser 113, cooperate with a small bar-shaped electrode 115, which has a constant length. In order to vary the working front, two suitable dielectric thicknesses 117 are inserted side by side between the electrodes, which prevent the effect of discharges by circumscribing the working front therebetween.

It is intended that the drawing shows only an example given just as a practical embodiment of the invention, which invention can vary in forms and arrangements without however departing from the scope of the concept which informs the invention itself.

CLAIMS

1. A device for processing plastics surfaces and other materials through evenly distributed electric discharges on the surface to be processed, having two operative electrodes between which there is a constant high potential difference and between which the plastic to be processed passes, characterized in that one of the operative electrodes is divided into a plurality of elementary operative electrodes, each being connected to one of its condenser plate, the other plate of said condenser being connected to the high tension source to form thus a plurality of condensers in parallel.

2. A device according to claim 1, characterized in that the elementary electrodes are carried by a bar and cooperate with a cylinder-shaped electrode or the like to bear and deviate the advancing plastic to be processed.

3. A device as at least in claim 1, characterized in that it includes means to vary the active working front magnitude.

4. An apparatus as in claim 3, characterized in that the undivided electrode can be adjusted through its length or replaced since it is selected from a group of differently sized electrodes.

5. An appparatus as in claim 4, characterized in that the replaceable electrode consists of a small bar with two sliding parts, which is skimmed by the advancing plastic.

6. An apparatus as in claim 3, characterized in that dielectrics inserted in the space between the electrodes, especially from the sides, limit the active front to the space therebetween.

7. An apparatus as at least in claim 1, characterized in that the feeding plate is divided into a plurality of elementary plates independent from each other and apt to be gradually connected to the elecric power source through a collector or commutator to vary the number of the working elementary electrodes and thereby the area involved with the processing.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.